

**Remarks/Arguments:**

Claims 1-14 are pending in the application. Claim 8 is currently amended. No new matter has been added.

**Rejections under 35 U.S.C. §112**

Claims 2 and 8 stand rejected under 35 U.S.C. §112, second paragraph, as indefinite for failing to particularly point out and distinctly claim the subject matter of the invention.

Claim 2 is objected to because x is not defined for  $\text{Bi}(\text{NO}_3)_3 \cdot x\text{H}_2\text{O}$ . Applicants respectfully submit that claim 2 is clear on its face because this is conventional terminology in the art which means that the bismuth nitrate salt may have more than one hydrate form. Please see the attached Material Safety Data Sheet (MSDS) for bismuth nitrate, which shows bismuth nitrate in an anhydrous and a hydrate form (e.g.,  $\text{Bi}(\text{NO}_3)_3 \cdot 5\text{H}_2\text{O}$ ). The MSDS also explains under sections 9 and 10 that bismuth nitrate slowly decomposes in water to form subnitrate and is hygroscopic. Because bismuth nitrate is known to absorb water, a person of ordinary skill in the art would know that it is not possible to specifically determine x. Stated another way, unless the bismuth nitrate is "fresh" and/or precautions are taken to limit exposure to moisture, there are unspecified amounts of  $\text{H}_2\text{O}$  in the hydrate form. Accordingly, Applicants respectfully submit that it is not necessary to specify x, which is clear on its face to one of ordinary skill in the art.

Claim 8 is objected to for inclusion of "other glass frits and pigments." Claim 8 is currently amended to remove this limitation without prejudice or disclaimer of the subject matter thereof. No new matter has been added. Applicants respectfully submit this rejection is now moot in view of the claim amendment.

**Rejections under 35 U.S.C. §103**

Claims 1-4 and 6-14 stand rejected as unpatentable over U.S. Patent No. 5,443,669 ("Tünker") in view of PCT Publication No. WO97/36836 ("Peer"). Claim 5 stands rejected as unpatentable over Tünker and Peer and further in view of U.S. Publication No. 2002/014569 ("Nagai") or further in view of U.S. Publication No. 2002/0135281 ("Goda"). Applicants traverse these rejections and submit that the currently pending claims are patentable over these cited references for at least the reasons set forth below.

Claim 1 recites:

A ceramic ink, the ink comprising a glass frit, a pigment, an organic vehicle and an oxidising agent, wherein the oxidising agent comprises a bismuth salt of nitric acid.

"To establish a *prima facie* case of obviousness, ... the prior art reference (or references when combined) must teach or suggest all the claim limitations." M.P.E.P. §2143. Additionally, as set forth by the Supreme Court in KSR Int'l Co. v. Teleflex, Inc., 550 U.S. 398 (2007), it is necessary to identify a reason that would have prompted a person of ordinary skill in the relevant field to combine the prior art elements in the manner claimed.

Applicants respectfully submit that claim 1 is allowable for at least the foregoing reasons: (1) the reason provided for combining Tünker and Peer is erroneous; and (2) Peer is not analogous to Applicants' invention.

First, the Office Action alleges that the motivation to combine Tünker and Peer is "because it will improve the rheology of the sealing paste or prevent other chemical from being reduced." Office Action pg. 3. This reason for combining Tünker and Peer is erroneous, however, because Peer does not contemplate improving rheology but merely seeks to decrease the chemical reduction of PbO in a PbO-containing sealing glass to metallic lead during sealing or firing without causing any substantial adverse effect on the rheology. Furthermore, the other chemical being reduced is clearly specified in Peer as lead oxide, and reduction of lead oxide would not be a concern in Tünker after the proposed combination. No other basis has been provided to expand the disclosure in Peer to the reduction of other chemicals.

Tünker is directed to the production of a laminated glass pane utilizing a screen-printable enamel ink consisting essentially of a glass-flux paste, at least one ceramic pigment, an inorganic binder and an organic screen-printing oil. Col. 2, lines 54-57 of Tünker. The inorganic binder may also contain an oxygen-release agent to help reduce and eliminate gas evolution during the baking-on portion of the claimed process. Examples of inorganic oxygen sources are given in Tünker as lead dioxide, red lead, manganese oxide and mixtures thereof. Col. 3, lines 48-54 of Tünker. As indicated in the Office Action, Tünker fails to disclose an oxidizing agent comprising a bismuth salt of nitric acid. The Office Action, however, relies on Peer for disclosing  $\text{Bi}(\text{NO}_3)_3 \cdot 5\text{H}_2\text{O}$ .

Peer is directed to sealing glass compositions (also known as "solder" glasses) having a PbO constituent to seal the glass face plate to the glass funnel of a cathode ray tube. See pg. 1 of Peer. The PbO constituent in the sealing glass has a natural propensity to be reduced to metallic lead during heat sealing in a reducing atmosphere. Pg. 3 of Peer. To solve this problem a modifier, such as  $\text{Bi}(\text{NO}_3)_3 \cdot 5\text{H}_2\text{O}$ , is used. As explained at pg. 8 of Peer:

[T]he term "modifier" means any substance that can be used in an amount sufficient to prevent the PbO from being chemically reduced when the glass frit is being fired in the presence of reducing conditions at a temperature sufficient to seal the glass without having a substantial adverse effect on the properties of the sealing glass paste or the fired glass seal.

While Peer discusses that the rheology is not adversely affected by addition of this modifier, it does not purport to improve the rheology of the sealing paste as indicated in the Office Action. For instance, see the discussion at pg. 15 of Peer:

These modifiers are effective in decreasing the chemical reduction of PbO during firing and sealing of the glass **without causing any substantial adverse effect on the rheology** of the sealing glass paste or on the sealing properties of the base glass.

To infer from this statement that a reason exists to select a  $\text{Bi}(\text{NO}_3)_3 \cdot 5\text{H}_2\text{O}$  as a modifier because it improves the rheology, is a mischaracterization of Peer. Thus, the reason for combining Tünker and Peer of improving rheology is in error. Peer does not contemplate improving rheology but merely seeks to decrease the chemical reduction of PbO in a PbO-containing sealing glass to metallic lead during sealing or firing without adversely affecting rheology.

The alternative reason provided in the Office Action is "or prevent other chemical from being reduced." It is not just any chemical being reduced which is the concern in Peer. As discussed above, Peer is solving the problem of reduction of PbO containing sealing glass to metallic lead. While Peer discloses  $\text{Bi}(\text{NO}_3)_3 \cdot 5\text{H}_2\text{O}$  as a modifier, its function is to prevent PbO from being reduced to metallic lead. Thus, the other chemical being reduced is clearly specified in Peer as lead oxide.

The only lead described in Tünker is as an oxidizing agent (i.e., lead dioxide or red lead (minium)) or a type of glass (i.e., lead borosilicate glass). The oxidizing agents described in Tünker would not be a concern because it is necessarily replaced by  $\text{Bi}(\text{NO}_3)_3 \cdot 5\text{H}_2\text{O}$  as the

oxidizing agent in the claimed invention. The other lead compound disclosed in Tünker, lead borosilicate glass, is known in the art to be a stable glass, and thus, reduction of it is not a concern. Therefore, reduction of lead oxide would not be at issue in Tünker, after the proposed combination by the Examiner. Accordingly, a person of ordinary skill in the art would not have looked to Peer for inclusion of  $\text{Bi}(\text{NO}_3)_3 \cdot 5\text{H}_2\text{O}$  to add to Tünker to prevent lead oxide from being reduced.

No other basis has been provided in the Office Action or in the references to expand the disclosure in Peer to the reduction of "other chemicals." As discussed above, Peer contemplates preventing  $\text{PbO}$  from being reduced to metallic lead. Other than lead oxide, Peer does not contemplate reduction of "other chemicals." As no other basis is provided in the Office Action to expand the concern of reduction to other chemicals, the reason for combining the references provided is inadequate or in error.

Lastly, Tünker provides a specific list of possible oxidizing agents including lead dioxide, red lead, manganese oxide and mixtures thereof. Col. 3, lines 48-54 of Tünker. Thus, a person of skill in the art would first look to the list of oxidizing agents provided. There would be no motivation for a skilled person to look to a bismuth containing oxidant. Furthermore, a skilled person would understand that any oxidant would not be suitable in all applications. Tünker is explained in the specification as follows:

US 5,443,669 addresses the problems encountered using the third method described above by providing a ceramic ink incorporating an organic vehicle which has high volatility, and an optional oxygen-releasing agent. The vehicle is largely evaporated during drying and, at elevated temperature during shaping, the agent provides the required oxygen to oxidise (burn-out) any remaining organic material in the ink. The present applicants have found however, that inks containing low volatility organic vehicles are problematic to print, and that the suggested oxygen-releasing agents, lead dioxide, red lead and manganese dioxide are both detrimental to the fluid properties of inks and result in poor quality coatings. The printing properties of the inks can be improved by adding polymeric species however, vehicles containing high amounts of polymers have a tendency not to burn-out satisfactorily, even in the presence of the above mentioned oxygen-releasing agents. See pg. 2, line 27 to pg. 3, line 6 of the specification.

For a laminated glass, the polymers need to decompose (or burn-out) during firing, but there is limited oxygen for this to effectively occur, e.g., imperfections such as pinholes and craters can occur. The Applicants have found that adding the bismuth salts as an oxidant in the claimed

invention achieved efficient and complete burn-out without such imperfections (See Examples in specification showing homogenous, defect free decoration). In addition, Applicants respectfully submit that reliance on Peer is the impermissible use of hindsight. See MPEP §2141.01 ("The requirement 'at the time the invention was made' is to avoid impermissible hindsight."). As compared with the above results in Tünker using the oxygen-releasing agents suggested in Tünker, one of ordinary skill in the art would not look to use a bismuth salt of nitric acid as an oxidizing agent without knowledge gleaned only from Applicant's disclosure. Accordingly, there is no reason why a skilled person would combine the disclosure of Tünker by replacing the oxygen-releasing agents disclosed in Tünker with the modifier disclosed in Peer.

Turning to the second point, Applicants respectfully contend that Peer is not analogous to Applicants' invention. There are two bases for holding prior art analogous for an obviousness determination: 1) art from the same field of endeavor regardless of the problem addressed, or 2) art from different fields addressing the same problem. *State Contracting & Engineering Corp. v. Condotte America, Inc.*, 68 USPQ2d 1481 (Fed. Cir. 2003) (reversing district court's holding of non-obviousness and remanding because record presents a factual question as to whether the reference is analogous art); *Wang Laboratories, Inc. v. Toshiba Corp.*, 26 USPQ2d 1767 (Fed. Cir. 1993).

In this case, the field of the present invention is a ceramic ink, in particular ceramic inks suitable for application to automotive glass in the manufacture of laminated windscreens. On the other hand, the field of Peer is PbO-containing sealing glass compositions for sealing glass components such as television picture tubes. These fields are quite different. Turning to the problems addressed, the present invention addresses the problems associated with providing good quality coatings (minimal surface defects) suitable for use in the production of laminated glass with more efficient burn-out, which does not adversely affect the fluid properties of conventional organic vehicles. See pg. 3, lines 8-22 of the specification. On the other hand, the problem addressed by Peer is that the PbO constituent in the sealing glass has a natural tendency to be reduced to metallic lead during the course of heat sealing in a reducing atmosphere or in the presence of organic vapors. See pg. 3, lines 16-18 of Peer. Thus, the problems addressed by the present invention and Peer are far removed: In the present invention, the inks are lead-free, do not undergo a reduction step, and accordingly, there is no concern for reduction of a PbO constituent to metallic form; whereas in Peer, the bismuth

nitrate modifier is added to decrease the chemical reduction of PbO during firing and sealing of the glass when exposed to reducing conditions.

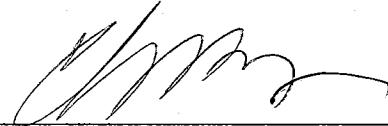
Thus, as the reason provided for combining Tünker and Peer is erroneous, and Peer is nonanalogous art; a *prima face* case of obviousness has not been shown or has been rebutted. It is respectfully submitted that independent claim 1 is in condition for allowance. Claims 2-14 depend from claim 1 and therefore should each be allowed for at least the reasons set forth above.

The Office Action further relies upon references Nagai and Goda with respect to claim 5. Applicants submit that Nagai and Goda do not remedy the deficiencies of Tünker and Peer. Furthermore, a skilled person would not have looked to Nagai or Goda as neither of the references teach an oxidizing agent comprising a bismuth salt of nitric acid. Accordingly, claim 5 should be allowable for at least the reasons set forth above.

### **Conclusion**

For all of the foregoing reasons, Applicants respectfully request reconsideration and allowance of the claims. Applicants invite the examiner to contact their undersigned representative if it appears that this may expedite examination.

Respectfully submitted,



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Christopher R. Lewis, Reg. No. 36,201  
Attorney for Applicants

CRL/CEB/lrb  
Attachment: MSDS Bismuth Nitrate

Dated: May 11, 2009

P.O. Box 980  
Valley Forge, PA 19482-0980  
610-407-0700

The Director is hereby authorized to charge  
or credit Deposit Account No. **18-0350** for  
any additional fees, or any underpayment or

Appln. No.: 10/525,186  
Amendment Dated May 11, 2009  
Reply to Office Action of December 9, 2008

JMYT-345US

credit for overpayment in connection  
herewith.

L\_H:\NRPORTBL\RP\LISA\438405\_1.DOC

MSDS Number: **B3396** \* \* \* \* \* Effective Date: **05/11/07** \* \* \* \* \* Supersedes:  
**08/24/05**

**MSDS** Material Safety Data Sheet

From: Mallinckrodt Baker, Inc.  
222 Red School Lane  
Phillipsburg, NJ 08865



24 Hour Emergency Telephone: 908-659-2151  
CHEMTREC: 1-800-424-9300

National Response in Canada  
CANUTEC: 613-996-6566

Outside U.S. and Canada  
Chemtrec: 703-527-3887

NOTE: CHEMTREC, CANUTEC and National Response Center emergency numbers to be used only in the event of chemical emergencies involving a spill, leak, fire, exposure or accident involving chemicals.

All non-emergency questions should be directed to Customer Service (1-800-682-2537) for assistance.

# BISMUTH NITRATE

## 1. Product Identification

**Synonyms:** Nitric acid, bismuth (3+) salt, pentahydrate; bismuth ternitrate

**CAS No.:** 10361-44-1 (Anhydrous) 10035-06-0 (Pentahydrate)

**Molecular Weight:** 485.11

**Chemical Formula:** Bi(NO<sub>3</sub>)<sub>3</sub> 5H<sub>2</sub>O

**Product Codes:**

J.T. Baker: 1092, 1096

Mallinckrodt: 0252, 0256

## 2. Composition/Information on Ingredients

Ingredient	CAS No	Percent	Hazardous
Bismuth Nitrate	10361-44-1	99 - 100%	Yes



### 3. Hazards Identification

#### Emergency Overview

**DANGER! STRONG OXIDIZER. CONTACT WITH OTHER MATERIAL MAY CAUSE FIRE. HARMFUL IF SWALLOWED. CAUSES IRRITATION TO SKIN, EYES AND RESPIRATORY TRACT.**

**SAF-T-DATA<sup>(tm)</sup>** Ratings (Provided here for your convenience)

Health Rating: 2 - Moderate  
Flammability Rating: 0 - None  
Reactivity Rating: 3 - Severe (Oxidizer)  
Contact Rating: 1 - Slight  
Lab Protective Equip: GOGGLES & SHIELD; LAB COAT & APRON; VENT HOOD; PROPER GLOVES  
Storage Color Code: Yellow (Reactive)

#### Potential Health Effects

##### Inhalation:

May cause irritation to the respiratory tract. Symptoms may include coughing and shortness of breath.

##### Ingestion:

Bismuth salts are poorly absorbed. Should absorption occur, symptoms may include loss of appetite, headache, skin rashes, kidney damage, and rarely mild jaundice. Production of nitrites in the intestine may cause headache, flushing skin, vomiting, falling blood pressure, cyanosis, and in severe cases convulsions and coma.

##### Skin Contact:

May cause mild irritation.

##### Eye Contact:

May cause mild irritation.

##### Chronic Exposure:

Repeated or prolonged ingestion may cause a "bismuth line", black spots on the gums, foul breath, and salivation.

##### Aggravation of Pre-existing Conditions:

No information found.

### 4. First Aid Measures

##### Inhalation:

Remove to fresh air. Get medical attention for any breathing difficulty.

##### Ingestion:

Induce vomiting immediately as directed by medical personnel. Never give anything by mouth to an unconscious person. Get medical attention.

##### Skin Contact:

Wash exposed area with soap and water. Get medical advice if irritation develops.

**Eye Contact:**

Immediately flush eyes with plenty of water for at least 15 minutes, lifting upper and lower eyelids occasionally. Get medical attention.

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## 5. Fire Fighting Measures

**Fire:**

Not combustible, but substance is a strong oxidizer and its heat of reaction with reducing agents or combustibles may cause ignition.

**Explosion:**

Contact with oxidizable substances may cause extremely violent combustion.

**Fire Extinguishing Media:**

Use any means suitable for extinguishing surrounding fire. Water spray may be used to keep fire exposed containers cool.

**Special Information:**

In the event of a fire, wear full protective clothing and NIOSH-approved self-contained breathing apparatus with full facepiece operated in the pressure demand or other positive pressure mode.

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## 6. Accidental Release Measures

Ventilate area of leak or spill. Wear appropriate personal protective equipment as specified in Section 8. Spills: Sweep up and containerize for reclamation or disposal. Vacuuming or wet sweeping may be used to avoid dust dispersal.

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## 7. Handling and Storage

Keep in a tightly closed container, stored in a cool, dry, ventilated area. Protect against physical damage. Separate from combustibles, organic or other readily oxidizable materials. Avoid storage on wood floors. Containers of this material may be hazardous when empty since they retain product residues (dust, solids); observe all warnings and precautions listed for the product.

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## 8. Exposure Controls/Personal Protection

**Airborne Exposure Limits:**

None established.

**Ventilation System:**

A system of local and/or general exhaust is recommended to keep employee exposures as low as possible. Local exhaust ventilation is generally preferred because it can control the emissions of the contaminant at its source, preventing dispersion of it into the general work area. Please refer to the ACGIH document, *Industrial Ventilation, A Manual of Recommended Practices*, most recent edition, for details.

**Personal Respirators (NIOSH Approved):**

For conditions of use where exposure to dust or mist is apparent and engineering controls are not feasible, a particulate respirator (NIOSH type N95 or better filters) may be worn. If oil particles (e.g. lubricants, cutting fluids, glycerine, etc.) are present, use a NIOSH type R or P filter. For emergencies or instances where the exposure levels are not known, use a full-face positive-pressure, air-supplied respirator. **WARNING:** Air-purifying respirators do not protect workers in oxygen-deficient atmospheres.

**Skin Protection:**

Wear protective gloves and clean body-covering clothing.

**Eye Protection:**

Use chemical safety goggles. Maintain eye wash fountain and quick-drench facilities in work area.

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## 9. Physical and Chemical Properties

**Appearance:**

Transparent, colorless crystals.

**Odor:**

Slight nitric acid odor.

**Solubility:**

Slowly decomposes in water to form subnitrate.

**Density:**

2.83

**pH:**

No information found.

**% Volatiles by volume @ 21C (70F):**

0

**Boiling Point:**

Not applicable.

**Melting Point:**

75 - 80C (167 - 176F) Decomposes.

**Vapor Density (Air=1):**

No information found.

**Vapor Pressure (mm Hg):**

No information found.

**Evaporation Rate (BuAc=1):**

No information found.

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## 10. Stability and Reactivity

**Stability:**

Stable under ordinary conditions of use and storage. Hygroscopic.

**Hazardous Decomposition Products:**

Toxic metal fumes may form when heated to decomposition.

**Hazardous Polymerization:**

Will not occur.

**Incompatibilities:**

Strong acids, strong reducing agents, powdered metals and organic/combustible/easily oxidizable materials.

**Conditions to Avoid:**

Heat, moisture, dusting, contact with combustibles and incompatibles.

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## 11. Toxicological Information

For bismuth nitrate pentahydrate; LD50 oral rat: 4042 mg/Kg Investigated as a reproductive effector.

-----\Cancer Lists\-----

---NTP Carcinogen---

Ingredient	Known	Anticipated	IARC Category
Bismuth Nitrate (10361-44-1)	No	No	None

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## 12. Ecological Information

**Environmental Fate:**

No information found.

**Environmental Toxicity:**

No information found.

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## 13. Disposal Considerations

Whatever cannot be saved for recovery or recycling should be managed in an appropriate and approved waste disposal facility. Processing, use or contamination of this product may change the waste management options. State and local disposal regulations may differ from federal disposal regulations. Dispose of container and unused contents in accordance with federal, state and local requirements.

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## 14. Transport Information

### Domestic (Land, D.O.T.)

**Proper Shipping Name:** NITRATES, INORGANIC, N.O.S. (BISMUTH NITRATE)

**Hazard Class:** 5.1

**UN/NA:** UN1477

Packing Group: II

**Information reported for product/size:** 500G

### International (Water, I.M.O.)

**Proper Shipping Name:** NITRATES, INORGANIC, N.O.S. (BISMUTH NITRATE)

**Hazard Class:** 5.1

**UN/NA:** UN1477

Packing Group: II

**Information reported for product/size:** 500G

### International (Air, I.C.A.O.)

**Proper Shipping Name:** NITRATES, INORGANIC, N.O.S. (BISMUTH NITRATE)

**Hazard Class:** 5.1

**UN/NA:** UN1477

Packing Group: II

**Information reported for product/size:** 500G

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## 15. Regulatory Information

### -----\Chemical Inventory Status - Part 1\-----

Ingredient	TSCA	EC	Japan	Australia
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Bismuth Nitrate (10361-44-1)	Yes	Yes	Yes	Yes
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### -----\Chemical Inventory Status - Part 2\-----

--Canada--

Ingredient	Korea	DSL	NDSL	Phil.
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Bismuth Nitrate (10361-44-1)	Yes	Yes	No	No
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### -----\Federal, State & International Regulations - Part 1\-----

-SARA 302- -----SARA 313-----

Ingredient	RQ	TPQ	List	Chemical Catg.
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Bismuth Nitrate (10361-44-1)      No   No   No   Nitrate Cmpd

-----\Federal, State & International Regulations - Part 2\-----

-RCRA-   -TSCA-

Ingredient                      CERCLA   261.33   8(d)

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Bismuth Nitrate (10361-44-1)      No      No      No

Chemical Weapons Convention: No   TSCA 12(b): No   CDTA: No

SARA 311/312: Acute: Yes   Chronic: No   Fire: No   Pressure: No

Reactivity: Yes      (Pure / Solid)

**Australian Hazchem Code:** 1[T]

**Poison Schedule:** None allocated.

**WHMIS:**

This MSDS has been prepared according to the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all of the information required by the CPR.

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## 16. Other Information

**NFPA Ratings:** Health: **1** Flammability: **0** Reactivity: **1** Other: **Oxidizer**

**Label Hazard Warning:**

DANGER! STRONG OXIDIZER. CONTACT WITH OTHER MATERIAL MAY CAUSE FIRE. HARMFUL IF SWALLOWED. CAUSES IRRITATION TO SKIN, EYES AND RESPIRATORY TRACT.

**Label Precautions:**

Keep from contact with clothing and other combustible materials.

Do not store near combustible materials.

Store in a tightly closed container.

Remove and wash contaminated clothing promptly.

Avoid contact with eyes, skin and clothing.

Avoid breathing dust.

Wash thoroughly after handling.

**Label First Aid:**

If swallowed, induce vomiting immediately as directed by medical personnel.

Never give anything by mouth to an unconscious person. In case of contact, immediately flush eyes or skin with plenty of water for at least 15 minutes. If inhaled, remove to fresh air. Get medical attention for any breathing difficulty. In all cases, get medical attention.

**Product Use:**

Laboratory Reagent.

**Revision Information:**

MSDS Section(s) changed since last revision of document include: 14.

**Disclaimer:**

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**Prepared by:** Environmental Health & Safety

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